A study of clinical and electrophysiological correlation in patients with alcoholic neuropathy

Submitted in partial fulfillment of the requirements
towards the conferment of

BRANCH - 1 DM NEUROLOGY

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CERTIFICATE

This is to certify that the dissertation entitled **"A study of clinical and electrophysiological correlation in patients with alcoholic neuropathy"** is a bonafide original work of **DR.S.HARIHARAN**, in partial fulfillment of the requirements for D.M. Branch - I (NEUROLOGY) Examination of the Tamil Nadu Dr. M.G.R Medical University to be held in AUGUST 2013, under our guidance and supervision.

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DECLARATION

I hereby solemnly declare that this dissertation titled **"A study of clinical and electrophysiological correlation in patients with alcoholic neuropathy"** was done by me in Institute of Neurology, Madras Medical college and Rajiv Gandhi Government General Hospital, Chennai - 3, under the guidance and supervision of **Prof. Dr. C. Mutharasu M.D., D.M., and Dr. S. Balasubramanian M.D.,D.M.,** Professor of Neurology, Institute of Neurology, Madras Medical College & Rajiv Gandhi Government General Hospital, Chennai. This dissertation is submitted to the Tamil Nadu Dr. M.G.R. Medical University towards the partial fulfillment of requirement for the award of D.M Degree Branch I (NEUROLOGY).

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CONTENTS

INTRODUCTION

Peripheral neuropathies are caused by dysfunction of peripheral motor, sensory and autonomic nerves.

Alcoholic neuropathy is commonly seen neuropathy in general practice. Depending on the diagnostic criteria used, its frequency varies from 12.5% to 48.6% in chronic alcoholism [(1)]. Covert alcoholism may only be uncovered by a focused history provided by family members.

Alcoholic neuropathy commonly presents with sensory neuropathic symptoms like paresthesias and burning sensation over both feet with or without motor symptoms.

A close association between alcoholic neuropathy and nutritional deficiency is well documented. The neuropathic picture of chronic alcoholism is essentially indistinguishable from thiamine deficiency.

To some physicians, neuropathy is present only when symptoms or signs appear but others may diagnose alcoholic neuropathy based solely on electrophysiological, quantitative sensory testing or autonomic abnormalities.

In general, the diagnosis of a definite alcoholic neuropathy should be based on clinical symptoms, objective neurological signs and electrodiagnostic confirmation.

This study was undertaken to analyse the clinic - electrophysiological correlation in patients with alcoholic peripheral neuropathy.

AIM OF THE STUDY

1. To study and analyse the clinical symptomatology and signs of peripheral neuropathy in patients with alcoholism, using appropriate scoring system.

2. To determine the correlation between clinical features and findings on nerve conduction studies.

3. To analyse autonomic dysfunction in patients with alcoholic neuropathy.

REVIEW OF LITERATURE

Introduction:

Although alcohol abuse and dependency are commonly called alcoholism, the text revision of the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) does not use the term because it lacks a precise definition.

Alcohol dependence is defined in DSM-IV as repeated alcohol-related difficulties in at least three of seven areas of functioning that cluster together over a 12-month period. Two of these seven items, withdrawal and tolerance, may have special importance as they are associated with a more severe clinical course.

Alcohol abuse is defined as repetitive problems with alcohol in any one of four life areas - social, interpersonal, legal, and occupational - or repeated use in hazardous situations such as driving while intoxicated. If an individual is not alcohol dependent, he or she still may be given a diagnosis of alcohol abuse.

About 50% of those with alcohol abuse continue to have alcohol problems 2 - 5 years later, but only 10% of these patients including adolescents - go on to develop alcohol dependence.

Rates are generally similar in the United States, Canada, Germany, Australia, and the United Kingdom; tend to be lower in most Mediterranean countries, such as Italy, Greece, and Israel; and may be higher in Ireland, France, and Scandinavia. Even higher lifetime prevalence has been reported for most native cultures, including American Indians, Eskimos, Maori groups, and aboriginal tribes of Australia. These differences reflect both cultural and genetic influences, as described below. Lifetime risk for alcoholism among physicians is similar to that of the general population.

Genetics:

Approximately 60% of the risk for alcohol use disorders is attributed to genes, as indicated by the fourfold higher risk for alcohol abuse and dependence in children of alcoholics and a higher risk in identical twins as compared to fraternal twins of alcoholics [(2)]. The genetic variations appear to operate primarily through intermediate characteristics that subsequently relate to the environment in altering the risk for heavy drinking and alcohol problems.

Structure of Peripheral Nerves:

The Peripheral Nervous System (PNS) includes all neuronal elements lying outside the pia mater of the spinal cord and brainstem with

the exception of cranial nerves - the optic nerves and olfactory bulbs, which are but special extensions of the brain [3].

The peripheral nerve is a cable-like structure containing bundles of both unmyelinated and myelinated fibers and their supporting elements. The unmyelinated axons are surrounded only by the plasma membrane of a Schwann cell.

The myelinated axons are engulfed by a Schwann cell that wraps around the axons multiple times, thereby insulating the axon with multiple layers of lipid-rich cell membrane. The myelinated axon is surrounded completely by myelin and Schwann cells except at regular gaps called the nodes of Ranvier, which measure approximately 1 μm in adults [4].

The propagation of action potentials from one node of Ranvier to the next (salutatory conduction) is maintained by a thick myelin sheath with low capacitance and high resistance to electric current.

Symptomatology [4]:

Motor system:

Positive motor symptoms	Negative motor symptoms
Cramps	Weakness
Twitching	Fatigue
Myokymia	Wasting

Tremor	

Sensory system:

Positive sensory symptoms	**Negative sensory symptoms**
Paresthesias	Numbness
Pins and needles	Cotton wool sensation
Burning sensation	Foot deformities
Tingling sensation	Painless ulcerations
Dysesthesias, Allodynia	
Tightness	

Autonomic Symptoms:

Positive symptoms	**Negative symptoms**
Hyperhydrosis	Orthostatic hypotension
Diarrhea	Erectile dysfunction
Gastroparesis - nausea, vomiting	Anhydrosis
	Constipation

Classification of peripheral neuropathy:

1. Based on histopathology [1]

- Cell body (neuronopathy)

  Sensory Gangliopathy

Motor neuronopathy

- Demyelinating
- Axonal

2. Time course [5]

- Acute (< 1 mon)
- Subacute (1 - 6 mon)
- Chronic (> 6 mon)
- Longstanding heritable
- Recurrent

3. Fiber type involvement [5]

- Motor Vs Sensory
- Large Vs Small
- Somatic Vs Autonomic

4. Anatomical location [5]

- Mononeuropathy
- Plexopathy
    - Brachial plexopathy
    - Lumbar plexopathy
    - Sacral plexopathy
- Radiculopathy [5]
    - Cervical radiculopathy
    - Thoracic radiculopathy

    - Lumbosacral radiculopathy
- Multiple mononeuropathy (mononeuropathy multiplex)
- Polyneuropathy
    - Symmetrical polyneuropathy
    - Asymmetrical polyneuropathy
- Polyradiculoneuropathy.
- Distal symmetrical Polyneuropathy
- Polyradiculopathy
- Single Mononeuropathy
- Multiple Mononeuropathies
- Focal root, plexus, or nerve disorders

Pathological Processes Involving Peripheral Nerves [6]:

Depends on pathological processes grouped into

1. Wallerian degeneration
2. Axonal degeneration
3. Neuronal (perikaryal) degeneration or neuronopathy
4. Segmental demyelination

Most polyneuropathies are fairly symmetrical, but some are asymmetrical and may be confused with confluent mononeuropathy

multiplex. A small number of polyneuropathies (e.g., that associated with acute intermittent porphyria [AIP]) can be predominantly proximal.

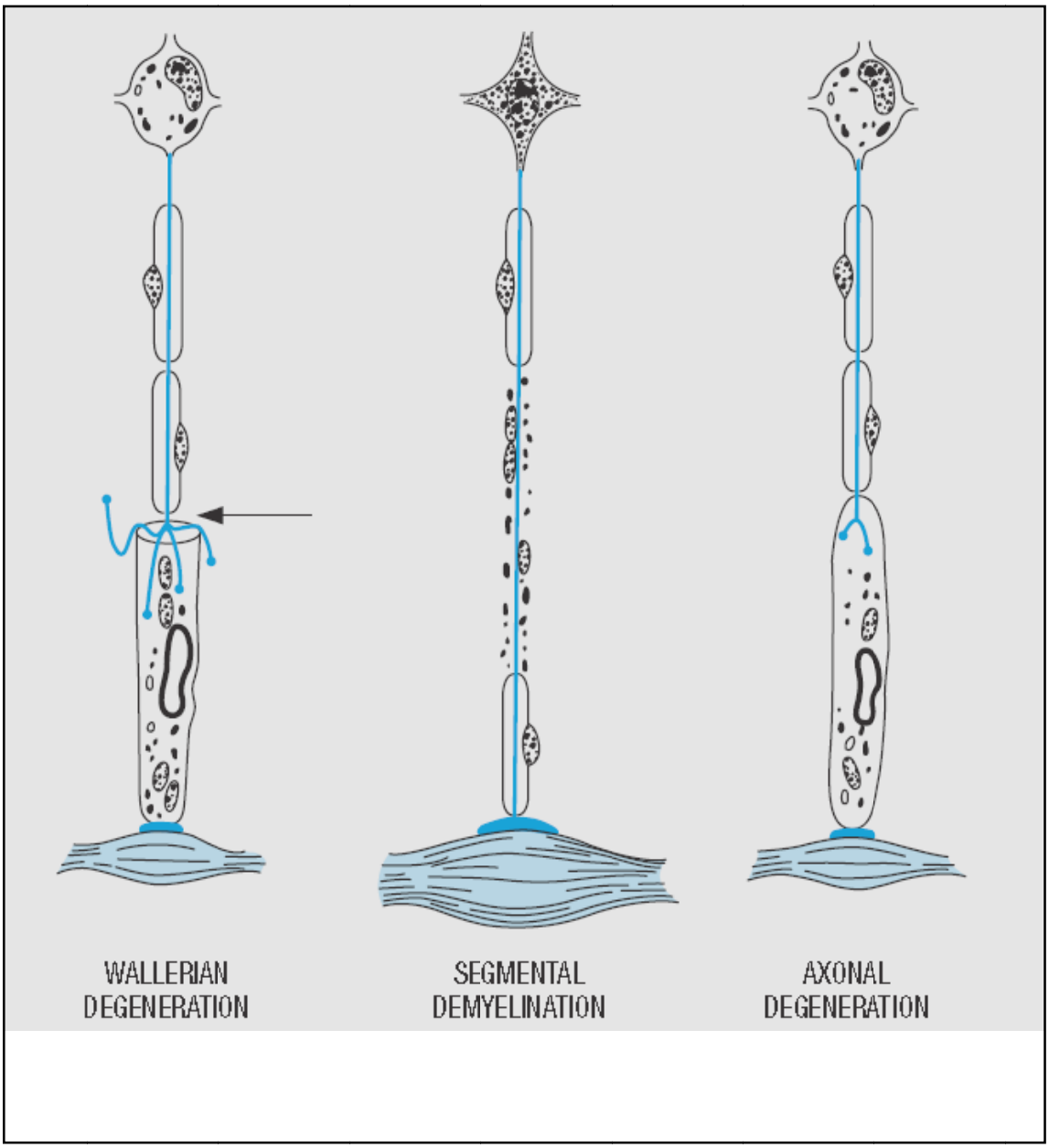


Figure 1: Above diagram showing pathological process affecting peripheral nerves: Wallerian degeneration, demyelination and axonal degeneration

Neurological and Medical Complications of Alcohol Use [7]:

1. Alcohol intoxication [8]

Acute intoxication

Pathological intoxication (atypical, complicated, unusual)

Blackouts

2.Alcohol withdrawal syndromes

Tremulousness

Alcoholic hallucinosis

Withdrawal seizures

Delirium tremens [9]

3.Nutritional diseases due to alcohol abuse

Werniecke's encephalopathy [10]

Korsakoff syndrome [11]

Cerebellar degeneration

Neuropathy

Optic neuropathy

Pellagra

4.Alcoholic disorders of uncertain pathogenesis [12]

Central pontine myelinolysis

Marchiafava-Bignami disease [13]

Fetal alcohol syndrome [14, 15]

Alcoholic dementia [16]

Cortical atrophy [17, 18]

Myopathy [19]

5. Neurological complications due to systemic diseases

Hepatic disease

Hepatic encephalopathy

Non-Wilsonian chronic hepatocerebral degeneration

Gastrointestinal diseases

Malabsorption syndromes

Postgastrectomy syndromes

Pancreatic encephalopathy

Cardiovascular diseases

Cardiomyopathy with potential cardiogenic emboli and storke

Arrhythmias and abnormal blood pressure leading to stroke

Infectious disease, especially meningitis (especially pneumococcal and meningococcal)

Hypothermia and hyperthermia

Hypotension and hypertension

Respiratory depression and associated hypoxia

Electrolyte imbalances leading to acute confusional states and neurological signs and symptoms [20]

Hypoglycaemia

Hyperglycaemia

Hyponatremia

Hypercalcemia

Hypomagnesaemia

Hypophosphatemia

Trauma

Epidural, subdural, and intracerebral hematoma

Posttraumatic seizure disorders

Compressive neuropathies and brachial plexus injuries

Posttraumatic symptomatic hydrocephalus

Muscle crush injuries and compartmental syndromes

Alcoholic neuropathy:

Etiology:

Direct toxic effect of alcohol and deficiency of thiamine and other B vitamins, caused by inadequate dietary intake, impaired absorption, and greater demand for thiamine to catalyze the metabolism of the alcohol are considered the major cause of polyneuropathy in alcoholic patients [22].

Direct effects of alcohol and its metabolite:

Role of acetaldehyde:

Acetaldehyde reduces glutathione formation, impairment of mitochondrial electron transport chain, inhibition of DNA repair, and stimulation of immunologic reactivity which results in peripheral nerve dysfunction [23].

As figure 3 depicts, various mechanism at molecular level involved in the development of alcoholic neuropathy and neuropathic pain are

1. Acetaldehyde induced oxidatine-nitrodative stress which results in overproduction of cytokines [24].
2. Over-activation of protein kinase C.
3. Role for ERK (Extracellular signal-regulated kinases) signalling [25].

In a study by Zambelis et al. (2005), ethanol per se plays a major role in the development of neuropathy in alcoholics.

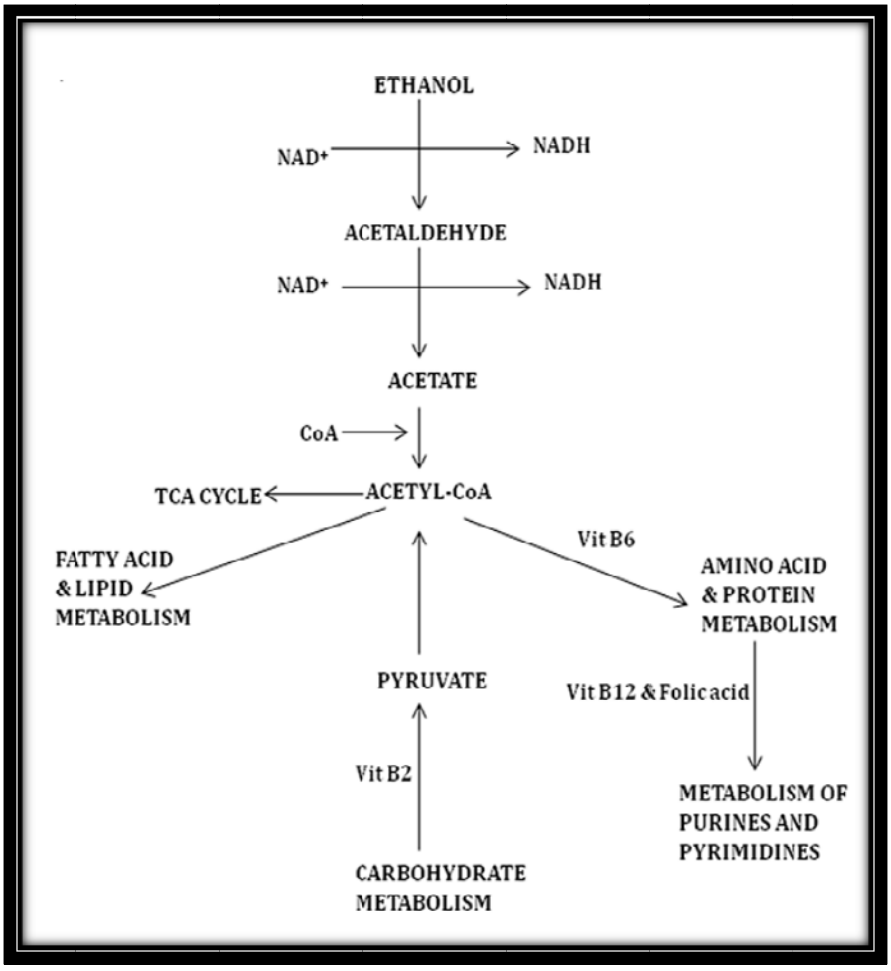
2. Role of thiamine in alcoholic neuropathy:

Victor and Adams (1961), Novak and Victor (1974) and Koike et al. compared the clinic pathologic features of thiamine deficiency neuropathy due to dietary imbalance in postgastrectomy patients and beriberi neuropathy and they concluded that both conditions are similar manifestations- sensory predominant neuropathy.

Subsequent electrophysiological studies by Ohnishi et al., 1980; Koike et

al., 2001a; Bosch et al., 1979; and Tackmann et al., 1977 in postgastrectomy thiamine deficiency patients and beriberi neuropathy patients showed similar electro physiological and histopathological features - axonal neuropathy.

Figure 2: Metabolism of alcohol and its derivatives [21]



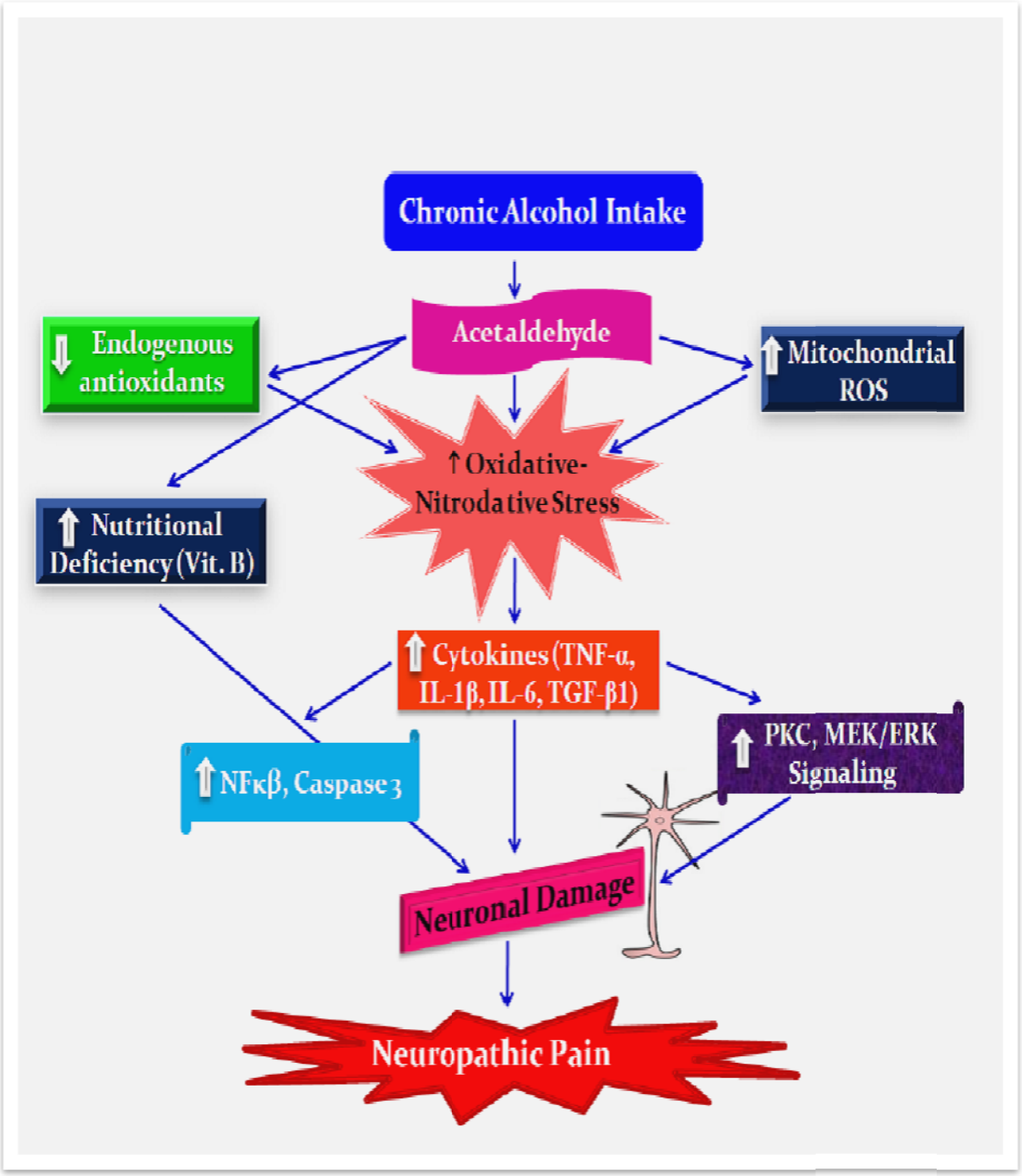


Figure 3: showing various mechanisms in the development of alcoholic neuropathy and neuropathic pain

These studies lead to the the concept of alcoholic neuropathy, encompasses both direct neurotoxicity of ethanol or its metabolites and the concomitant effects of nutritional status, especially thiamine deficiency.

In a study by Koike et al., 2004, pure alcoholic neuropathic patients without thiamine deficiency had sub acute onset small fiber predominant painful neuropathy whereas thiamine deficiency patients had acute in onset motor predominant neuropathy.

3. Role of nutritional status other than thiamine deficiency:

In a Danish study Behse and Buchthal et al, deficiency of B Vitamins other than thiamine deficiency may contribute in the development of alcoholic neuropathy.

Clinical features:

In chronic alcoholics, sensory symptoms commence in the feet and advance proximally in the gradual length-dependent manner associated with distal axonopathy. Eventually, legs to the knees and hands are involved [(26)]. Numbness, tingling, or discomfort (hot and cold or burning sensations) in the toes is frequent initial complaints, followed by unsteady gait.

Pain is widely held to be a hallmark of alcoholic neuropathy [(27)]. Pain in alcoholic neuropathy is variable; it may be fleeting or persistent and can be mild and annoying or severe and disabling. Common

complaints are cold, boring, burning, sticking, or lightning-like sensations in the feet and distal legs.

Cramping sensations in the legs are common, as is nocturnal allodynia evoked by rubbing the feet against bedclothes; symptomatic weakness is also reported. Autonomic symptoms or subtle evidence of autonomic dysfunction frequently are present from the beginning.

Autonomic symptoms may be sudomotor (dry skin due to lack of sweating or excessive sweating in defined areas), pupillary (poor dark adaptation, sensitivity to bright lights), cardiovascular (postural lightheadedness, fainting), urinary (urgency, incontinence, dribbling), gastrointestinal (diarrhea, constipation, nausea, or vomiting), and sexual (erectile impotence and ejaculatory failure in men, loss of ability to reach sexual climax in women). Early physical findings are symmetrically impaired vibratory, position, touch, thermal, and pain senses in the distal lower limbs that slowly move proximally over time; impaired vibratory sense is often a heralding sign. Impairment of small-fiber sensation may be profound, with ulceration of the soles and joint deformities [(28)]. Weakness, if present, is mild and distal; wasting of the extensor digitorum brevis is occasionally present.

Electrodiagnostic Studies:

It is helpful to follow a decision-making pathway based initially on the overall pattern of distribution of deficits, followed by the electrophysiological findings, and finally the clinical course.

Electrodiagnostic studies, carefully performed and directed to the particular clinical situation, play a key role in the evaluation by

(1) Confirming the presence of neuropathy,

(2) Precisely locating focal nerve lesions, and

(3) Giving information as to the nature of the underlying nerve pathology [29] (Gooch and Weimer, 2007; Wilbourn, A.J., 2002).

Nerve Conduction Studies

Demyelination is present if motor and sensory nerve conduction velocities (NCVs) are reduced to less than 70% of the lower limits of normal, with relative preservation of response amplitudes [30].

Temporal dispersion of compound muscle action potentials, motor conduction block, marked prolongation of distal motor and F-wave latencies are all features consistent with acquired demyelination [31].

Axonopathies result in low-amplitude sensory nerve action potentials and compound muscle action potentials, but they affect distal latencies and conduction velocities only slightly.

Alcoholic neuropathy had axonal changes in the NCS, predominantly involving sensory nerves of lower limbs which was

observed by various investigators like Coers and Hildebrand et al 1965; Walsh and McLeod, 1970; and Blackstock et al., 1972.

Autonomic function tests [32]:

A. Test for cardiovascular autonomic regulation:

1. Cardiovagal heart rate tests

Heart rate response to deep breathing

Valsalva ratio

Heart rate response to standing

2Adrenergic function tests

Blood pressure and heart rate response to standing/tilt

Blood pressure responses to sustained hand grip

Blood pressure responses to valsava manoeuvre.

3. R-R interval variation studies reflecting sympathovagal balance

B. Tests for sudomotor and thermoregulatory function

Quantitative Sudomotor Axon Reflex Test

Thermoregulatory sweat test

Sympathetic skin response

Sweat imprint

C. Test for genitourinary autonomic regulation

D. Tests for gastrointestinal autonomic regulation

Treatment:

Consists of management alcoholism & its rehabilitation and treatment of neuropathy

Principal therapy [33]:

Abstinence from alcohol,

Addiction counseling,

Nutritionally balanced diet.

Supplementation with thiamine and other B vitamins is important. In patients with significant gastrointestinal symptoms, parenteral vitamin treatment is initially required. Improvement in the polyneuropathy may be very slow because it requires axonal regeneration

Rehabilitation [34]:

Patients should be reminded that only they can decide to avoid the consequences that will occur without changes in drinking. The process of motivational interviewing has been summarized by the acronym FRAMES: Feedback to the patient;

Responsibility to be taken by the patient;

Advice, rather than orders, on what needs to be done;

Menus of options that might be considered;

Empathy for understanding of the patient's thoughts and feelings; and

Self-efficacy, i.e., offering support for the capacity of the patient to succeed in making changes.

Both motivational interviewing and brief interventions can be carried out in 15-min sessions, but because patients do not always change behaviour right away, multiple meetings are often required to explain the problem, discuss optimal treatments, and explain the benefits of abstinence.

Medication for rehabilitation [35]:

1. Naltrexone: opioid antagonist, acts by inhibiting activity of dopamine mediated reward system at ventral tegmental system; usual dose is 50–150 mg/day or monthly preparation of 380mg [36].

2. Acamprosate: acamprosate inhibits NMDA receptors, decreasing mild symptoms of protracted withdrawal. Dose is 2g/day in divided doses. Several trials of combined naltrexone and acamprosate using doses similar to those noted above have reported that the combination may be superior to either drug alone, although not all studies agree.

3. Disulfiram: an acetaldehyde dehydrogenase inhibitor. The drug itself carries potential risks of depression, psychotic symptoms, peripheral neuropathy, and liver damage.

4. Other drugs tried:

Topiramate - anticonvulsant with effects on dopamine

Ondansetron – serotonin antagonist

Ramonibant - cannabinol receptor antagonist

At present, there are insufficient data to support their use in clinical settings.

Treatment of alcoholic neuropathy:

In addition to Abstinence from alcohol, addiction counseling, and nutritionally balanced diet, neuropathic pain management usually begins with tricyclic antidepressants (TCAs) such as amitriptyline, imipramine, and desipramine, which can reduce burning, aching, sharp, throbbing and stinging [37].

Duloxetine hydrochloride, a dual reuptake inhibitor of serotonin and norepinephrine, is approved for the management of neuropathic pain. Tramadol is also effective for painful neuropathy.

Anticonvulsants such as phenytoin, carbamazepine, clonazepam, gabapentin, topiramate, lamotrigine, and pregabalin are effective for lancinating pains.

Topical anesthetic agents including lidocaine, mexiletine, and capsaicin creams provide transient relief for focal neuropathic pain. Narcotics may be required for severe cases of refractory neuropathic pain.

MATERIALS & METHODS

1. Place of study: Department of Neurology, Madras Medical College, Chennai - 600 003

2. Type of Study: Cross sectional observational study

3. Period of Study: March 2011 to December 2012

4. Subject Selection: Alcoholic patients referred to neurology outpatient clinic as well as those admitted in neurology ward with symptoms suggestive of neuropathy were included.

MATERIALS

Selected patients were subjected to detailed history, clinical examination, blood pressure, bed side autonomic function tests, blood sugar estimation, complete blood count including peripheral smear study, Liver Function Test (LFT) including serum albumin, and nerve conduction studies.

Inclusion Criteria

Alcoholic patients with symptoms suggestive of peripheral neuropathy.

Exclusion Criteria

1. Patients with known case of diabetes /IGT.
2. Patients with chronic renal failure.
3. Patients with Liver disease/LFT abnormalities other than low albumin.
4. Patients with malignancy.
5. Patients on drugs known to cause peripheral neuropathy.
6. Patients with a family h/o inherited neuropathies.
7. Patients with h/o exposure to heavy metals and toxins.
8. Patients with h/o lumbar or cervical radiculopathy.
9. Patients with nutritional deficiencies.
10. Patients with collagen vascular diseases.
11. Patients with hypothyrodism, dysproteinemias, amyloidosis and AIDS.
12. Age more than 50 years.

METHODOLOGY

1. History with special emphasis on family history of alcoholism defined, as positive when one of the parents had history of alcohol abuse.

2. Details regarding duration of alcohol exposure.

3. A detailed history with screening for neuropathic symptoms.

4. Symptoms and signs were analysed using Utah Early Neuropathy Scale (UENS) scoring system [38].

5. Neurological examination including assessment of motor power examination in lower and upper limbs, pain, temperature, ankle jerk, and touch perception, timed vibration sense, position sense, Romberg's test, and presence of Postural hypotension

   Sensory examination - the instruments used were (i) a disposable pin (ii) cotton tip (iii) a 128Hz tuning fork.

6. Small fiber neuropathy was diagnosed in the presence of pins & needle sensation and burning sensation with autonomic symptoms whereas large fiber neuropathy was diagnosed in the presence of weakness, numbness and cotton wool sensation while walking with bare foot.

7. Electrodiagnosis

The RMS system with recommended filter settings was used for NCS.

A. Motor NCS:

1. Median and ulnar nerves

2. Tibial and peroneal nerves

3. Computation of distal latency, calculation of segmental conduction velocity and amplitude of action potential was done in all stimulated nerves.

4. F Wave analysis (F minimum latency, F estimate) was done in all peripheral nerves.

5. H Reflex analysis

B. Sensory NCS:

1. Ulnar and median nerves

2. Sural nerves in both lower limbs

3. Computation of latency, amplitude and calculation of segmental Conduction velocity all done in all stimulated nerves

C. Heart rate variability to deep respiration:

Heart variation to deep breathing was assessed by the technique as described by Shahani et al (1990). The patient was instructed to breath deeply at a rate of 6 per min (5 seconds for inspiration and 5 seconds for expiration). E/I ratios were calculated as the ratio of maximum PR interval to minimum PR interval.

Normal values by age for deep breath E/I ratio at different age:

16 - 20 years = > 1.23, 21 - 25 years = > 1.20, 26 - 30 years = > 1.18, 31 - 35 years = > 1.16, 36 - 40 years = > 1.14, 41 - 45 years = > 1.12, 46 - 50 years = >1.11

D. Sympathetic skin response:

Sympathetic skin response was recorded from the right palm and right sole using the method described by Shahani et al (1984). Standard surface electrodes were palced on the palm and dorsum of the right hand and sole and dorsum of the foot.

A minimum of ten random stimuli were given at each site before considering the SSR to be absent. For the purpose of analysis, the absence of an elicitable SSR was considered as abnormal.

The normal values representative for nerve conduction studies of various peripheral nerves were derived at after analysing the NCS of 50 age matched normal persons (controls).

Normal NCS value in age matched 50 controls

Sensory studies

SNAP'S	AMP (µV)	CV(m/s)
Median	>15	> 50
Ulnar	> 15	> 50
Sural	> 6	> 40

Motor studies:

CMAP'S	DL (ms)	Amp (mV)	CV (m/s)	F Wave lat (ms)
Median	<4	>5	>50	<31

Ulnar	< 3.5	>5	>50	<31
Tibial	<6	>4	>40	<56
Peroneal	<6	>2	>40	<56

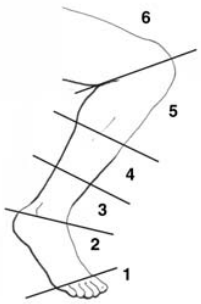
Patient Name
Study Number
Visit

The Utah Early Neuropathy Scale

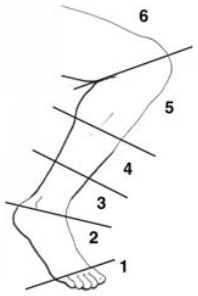
Motor Examination	Left	Right
0 normal 2 weak		
Great Toe Extension		
Total both sides (out of 4)		

Segments for pin sensation reporting

Left Leg



Right Leg



Pin Sensation:	L	R
0 normal		
1 for each segment with reduced sensation		
2 for each segment with absent sensation		
Total both sides (out of 24)		

Allodynia/Hyperesthesia	L	R
0 normal		
1 if present in toes or foot		
Total both sides (out of 2)		

Large Fiber Sensation	L	R
0 normal 1 diminished 2 absent		
Great toe vibration		
time	s	s
Great toe joint position		
Total both sides (out of 8)		

Deep Tendon Reflexes	L	R
0 normal 1 diminished 2 absent		
Ankle		
Total both sides (out of 4		

Total Score (out of 42)

Results

Table - 1: Age and Sex Distribution

Age in years	Number of patients	Sex distribution
< 30 yrs	9	All patients are male
30 - 40 yrs	17	
> 40 yrs	24	
Total	50	

Table - 2: Family h/o alcoholism

Positive Family history of alcoholism	Number of patients
Yes	19
No	31
Total	50

Table - 3: Duration of alcohol exposure

Age in years	Mean duration of alcohol exposure(Years)
< 30yrs	5.9 years
30 - 40 yrs	9.6 years
> 40 yrs	16.3 years
Mean age	9.8 years

Mean duration of alcohol exposure increases as age increases in patients with alcoholic neuropathy.

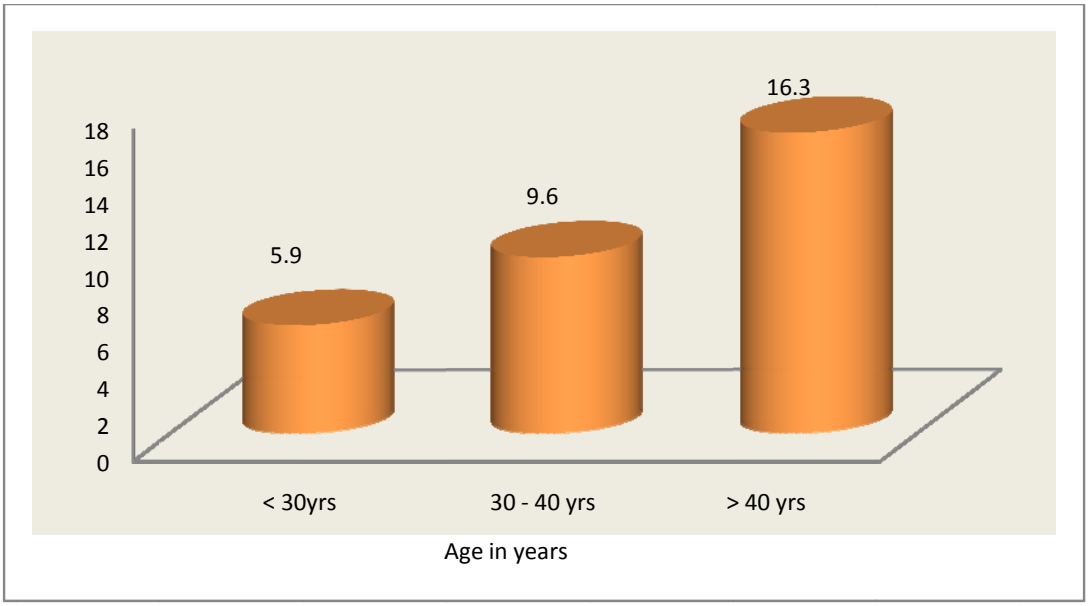
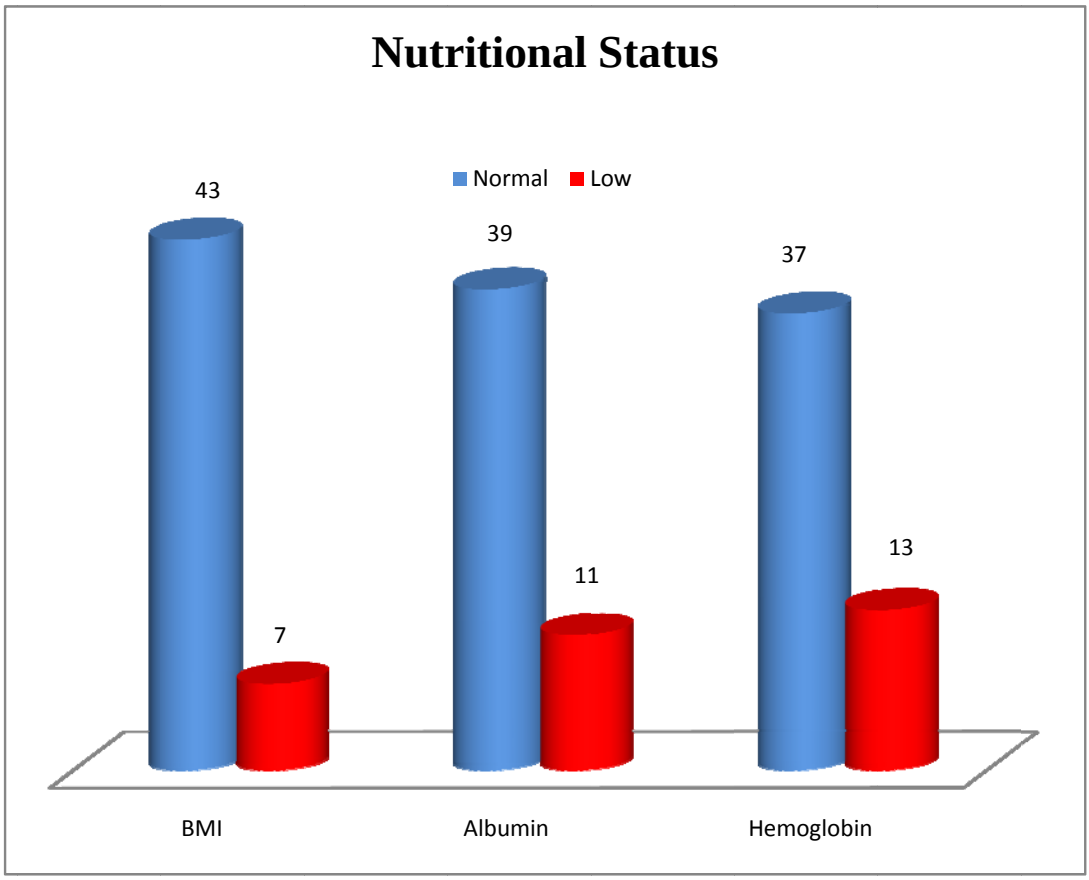


Table - 4: Nutritional Status

Age in years	BMI		Sr.Albumin		Hemoglobin	
	Nor	Low	Nor	Low	Nor	Low
< 30yrs	8	1	8	1	7	2
30 - 40 yrs	14	3	13	4	14	3
> 40 yrs	21	3	18	6	16	8
Total	43	7	39	11	37	13

Out of 50 patients with alcoholic neuropathy, 7 patients have low BMI, defined as BMI <25. Among 7 patients with low BMI, 3 patients were above 40 years of age, 3 patients were aged between 30 to 40 years whereas 1 patient was below 30 years.

11 patients out of 50 patients with alcoholic neuropathy had low serum albumin, defined as 3.5 grams/dl. Among 11 patients with low serum albumin, 1 patient was aged below 30 years, 4 patients were between 30 to 40 years and 6 patients were above 40 years of age.



13 patients out of 50 patients with alcoholic neuropathy had low blood hemoglobin, defined as 12 grams/dl. Among 11 patients with low blood hemoglobin, 2 patients were aged below 30 years, 3 patients were between 30 to 40 years and 8 patients had age above 40 years. No patient had severe anaemia, defined as Hemoglobin value of less than 7 grams/dl.

Peripheral smear study and other parameters were normal in all fifty subjects.

Table - 5: Sensory Symptoms

Out of 50 patients with alcoholic neuropathy, 41 patients had pins and needle sensation of the feet as their major sensory symptom, followed by burning sensation of their feet in 27 patients..

Symptoms	Number
Pins & needles sensation of feet	41
Burning feet	27
Numbness of feet	19
Hyperalgesia of feet	14
Allodynia	8
Unsteadiness in darkness	5

Table – 6: Sensory Symptom

Type of sensory symptom	Yes	No
Positive	**46**	**4**
Negative	**23**	**27**

46 patients out of 50 patients with alcoholic neuropathy presented with positive sensory symptoms whereas only 23 patients had negative sensory symptoms.

Table – 7: Autonomic Symptoms

Symptoms	Percentage
Erectile dysfunction	26%
Sweating disturbances	12%
Postural Giddiness	8%
Bladder disturbances	2%

Out of 50 patients with alcoholic neuropathy, most common autonomic symptom was erectile dysfunction which was noted in 13 patients, followed by sweating disturbances in 6 patients. Out of 13 patients with erectile dysfunction, they present either loss of erection or diificulty in sustaining erection.

4 patients have postural giddiness and 1 patient had bladder disturbances.

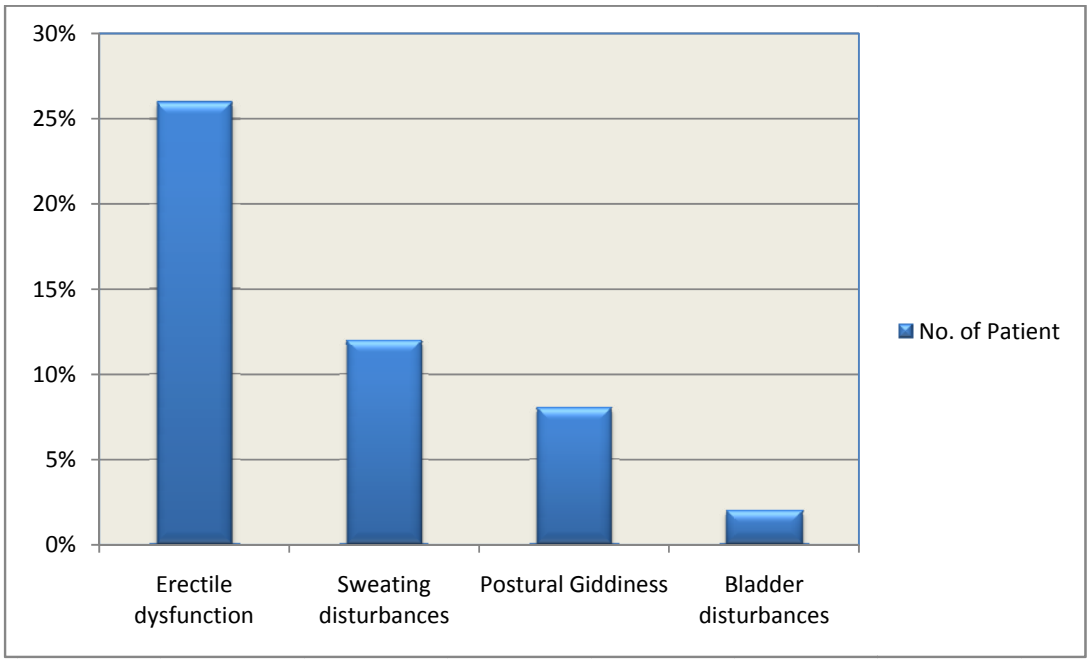


Table - 8: Motor Weakness of great toe

Normal	N	38
	%	76%
Weak	N	12
	%	24%

Out of 50 patients with alcoholic neuropathy, 12 patients had weakness of great toe extension. Out of 12 patients with great toe weakness, 5 patients have ankle weakness.

Table – 9: DTR (Upper Limb)

DTR Response	Number	Percentage
Normal	**42**	**84%**
Sluggish	**5**	**10%**
Absent	**3**	**6%**

Out of 50 patients with alcoholic neuropathy, 42 patients had normal upper limb deep tendon reflexes whereas 8 patients had hypo or areflexia in the upper limbs.

Table – 10: DTR (Lower limb)

DTR Response	Number	Percentage
Normal	**24**	**48%**
Sluggish	**17**	**34%**
Absent	**9**	**18%**

Out of 50 patients with alcoholic neuropathy, 34 patients had normal lower limb deep tendon reflexes whereas 16 patients had hypo or areflexia in the lower limbs.

Table -11: Clinical Diagnosis

Clinical Diagnosis	**No. of patient**
Sensory Neuropathy	28
Sensorimotor Neuropathy	9
Motor Neuropathy	0
Autonomic Neuropathy	0
Sensroy + Autonomic Neuropathy	10
Sensorimotor + Autonomic neuropathy	3
Total	50

Out of 50 patients with alcoholic neuropathy, 28 patients presented with sensory neuropathy, 9 patients with sensorimotor neuropathy, 10 patients with sensory and autonomic neuropathy, and 3 patients with sensorimotor with autonomic neuropathy. All neuropathy patients had features suggestive distal symmetrical polyneuropathy either sensory predominant or sensorimotor neuropathy. No patient had pure motor or autonomic neuropathy.

Table -12: Clinical Diagnosis (Based on fiber type)

Clinical Diagnosis	No of patient
Large Fiber	9
Small fiber	15
Large + small fiber	26
Total	50

Out of 50 patients with alcoholic neuropathy, 26 patients had clinically both large and small fiber involvement, 15 patients had small fiber involvement whereas 9 patients had clinically large fiber involvement.

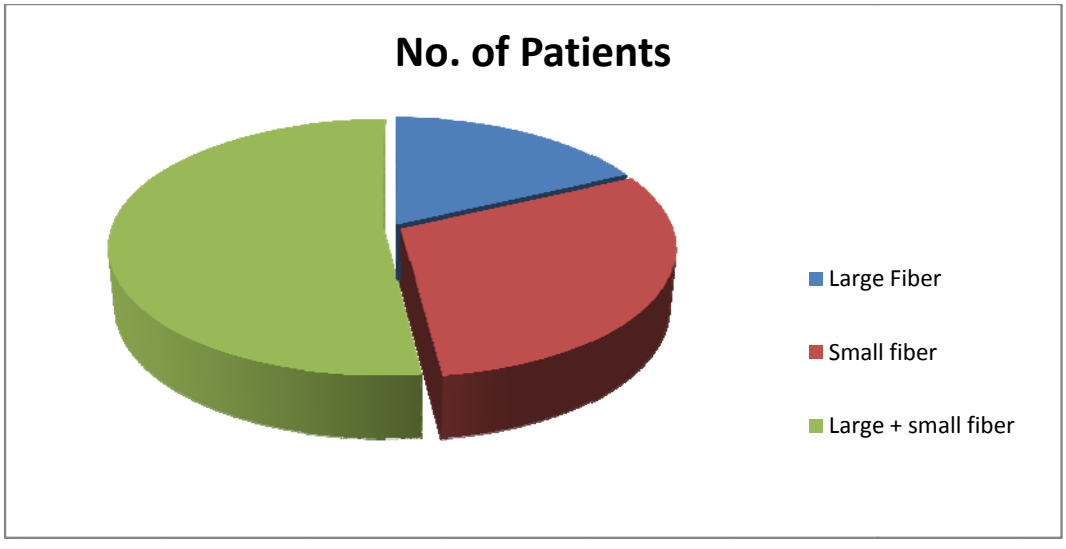


Table -13: UENS Score Vs Age

Age	No of Patients	Mean Score
Age < 30 yrs	9	21.4
Age 30 -40 yrs	17	26.7
Age >40yrs	24	33.2
Mean score		28.8

Out of 50 patients with alcoholic neuropathy, 9 patients with age less than 30 years had mean UENS Score of 21.4, 17 patients in 30 – 40 years of age had mean UENS Score of 26.7 and rest of 24 patients with age of above 40 years had mean UENS Scale Score of 33.2.

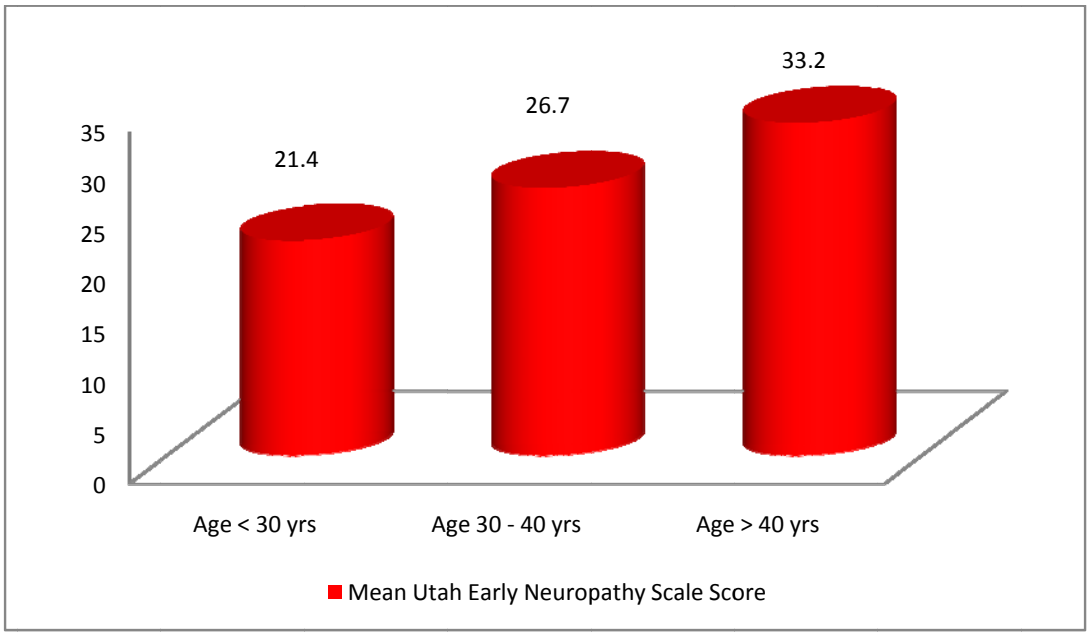


Table -14: UENS Scores Vs Duration of alcohol

Duration of Alcohol exposure	No of Patients	Mean Score
Less than 5 yrs	10	22.7
5 to 10 yrs	13	26.5
More10 yrs	27	32.2
Mean Score		28.8

Out of 50 patients with alcoholic neuropathy, 10 patients had mean duration of alcohol exposure of < 5 yrs with mean UENS Score of 22.7 ; 13 patients with mean duration of alcohol exposure of 5 - 10 yrs had mean UENS Score of 26.5 whereas 27 patients had mean duration of alcohol exposure of > 10 yrs with mean UENS Score of 32.2.

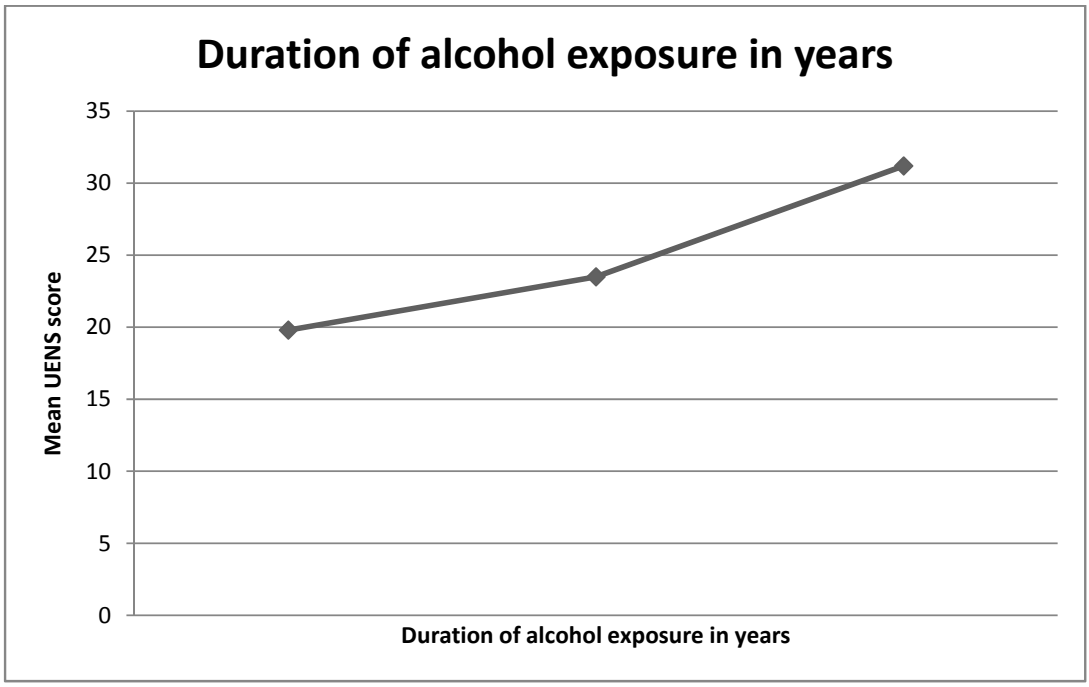


Table -15: UENS Scores Vs Autonomic Symtoms

UENS	No of Patients with Autonomic symp.	Mean Score
< 20	0	0
20 - 25	1	24
25 – 30	4	29.8
> 35	8	34.4
Total patients	13	32.1

Table -16: UENS Scores Vs Autonomic Symtoms

	No. Of patients (N = 50)	**Mean UENS Score**
Patients with Autonomic symptoms	13	32.1
Patients without Autonomic symptoms	37	27.6

Table –17: Upper Limb CMAP

Median	**Normal**	**Abnormal (Reduced CMAP)**	**Total**
Right	**46**	**4**	**50**
Left	**46**	**4**	**50**
Ulnar			
Right	**46**	**4**	**50**
Left	**46**	**4**	**50**

4 patients out of 50 patients had abnormal CMAPs (Compound Muscle Action Potential) in the form of reduced CMAPs in the upper limb motor nerves like Median and Ulnar nerves. Nerve conduction velocity and latency were normal.

Table –18: Lower Limb CMAP

Tibial	Normal	Abnormal	Total
Right	36	14	50
Left	36	14	50
Peroneal			
Right	36	14	50
Left	36	14	50

14 patients out of 50 patients had abnormal CMAPs (Compound Muscle Action Potential) in the form of reduced CMAPs**.** Nerve conduction velocity and motor latency were normal

Table –19: Upper Limb SNAP

Median	Normal	Abnormal	Total
Right	43	7	50
Left	43	7	50
Ulnar			

Right	**43**	**7**	**50**
Left	**43**	**7**	**50**

7 patients out of 50 patients had abnormal SNAPs (Sensory Nerve Action Potential) in the form of reduced SNAPs in the upper limb nerves like Median and Ulnar nerves.

Table –20: Lower Limb SNAP

Sural	Normal	Abnormal	Total
Right	**13**	**37**	**50**
Left	**13**	**37**	**50**

13 patients out of 50 patients had abnormal SNAPs (Sensory Nerve Action Potential) in the form of reduced SNAPs in the lowerr limb nerve.

Table -21: H reflex

Response	Yes
Normal	**21**
Abnormal	**29**

Out of 50 patients with alcoholic neuropathy, 21 patients had abnormalt H reflex.

TABLE - 22 NCS Vs UENS score

	No. Of patients (N= 50)	**Mean UENS Score**
Patients with Abnormal NCS	**37**	**29.7**
Patients with normal NCS	**13**	**26.2**

Table – 23: HRV

Response	**No. of patients (N= 50)**
Normal response	**35**
Abnormal response	**15**

Table – 24: Postural Hypotension

Response	No. of patients (N= 50)
Present	**9**
Absent	**41**

Table – 25: Sympathetic Skin Response

Stimulation Site	Recording site			
	Palm		Sole	
	SSR Normal	SSR abnormal	SSR Normal	SSR Abnormal
Median N.	44	6	40	10
Post. Tibial	40	10	36	14

Table 26: Clinical Symptoms Vs NCS abnormality

Out of 50 patients with alcoholic neuropathy, based on symptoms, 37 patients had abnormal NCS. Rest of the 13 patients had normal NCS study.

Duration of alcohol exposure	**No. Of patients with Abnormal NCS**	**No. Of patients with Normal NCS**
Less than 5yrs	1	**9**
5 to 10 yrs	10	**3**
More 10 yrs	26	**1**
Total	37	**13**

Statistical analysis**:**

In this study Pearson chi-square test was used for comparison. UENS Score was compared to age, duration of alcohol exposure, autonomic symptoms and NCS abnormalities and statistical significance was calculated. As age , duration of alcohol exposure and NCS abnormalities were associated with higher UENS score, suggesting of severe form of peripheral neuropathy.

Table 27: Statistical analysis:

	CHI SQUARE VALUE	P VALUE
UENS Score Vs Age	21.645	< 0.005 (Significant)
UENS Score Vs Duration of alcohol abuse	18.827	< 0.005 (Significant)
UENS Score Vs NCS abnormalities	11.574	< 0.005 (Significant)
UENS Score Vs Autonomic symptoms	4.198	> 0.005 (Insignificant)

DISCUSSION

In our study, it was found that among 50 patients with alcoholic neuropathy, 9 patients had age less 30 years, 17 patients had age between 30 - 40 years and rest of the 24 patients had age more than 40 years. There was a good correlation between age and incidence of alcoholic neuropathy.

Giovanni vittadini et al [39] in their clinical and epidemiological series showed that subjective symptoms and sign were increased significantly with age. In their study of 48 alcoholic neuropathic patients, they noticed that after the age of 40 years, incidence of polyneuropathy increases significantly due to alcohol exposure.

Behese and Buchtal et al, 1997 and Wetterling et al, 1999 also showed that duration of alcohol abuse was the most important factor in the development of polyneuropathy.

In our study, all patients were male; because the prevalence of alcohol abuse in women was less in our part of country. In a similar study by A Ammendola et al, out of 62 patients, majority of patients were male. Giovanni vittadini et al [39] observed that more than 70% of alcoholic neuropathic in their series were male.

19 out of 50 patients with alcoholic neuropathy in our study had positive family history of alcohol abuse. Incidence of alcoholic neuropathy increases in patients with positive family history of alcohol abuse; and also the effects of alcoholism and abusive tendency were increased in these patients. Hrubec Z et al [(40)] showed increased incidence of alcohol abuse and alcohol related end organ damage like neuropathy in family, presents which was probably due to a genetic predisposition.

Mean duration of alcohol exposure increases as age increases in patients with alcoholic neuropathy. In our study, 9 patients with age less than 30 years, had alcohol exposure of 5.9 years, 17 patients with age between 30 - 40 years had alcohol exposure of 9.6 years whereas 24 patients age more than 40 years patients had alcohol exposure of 16.3 years.

In an alcoholic epidemiological study, Giovanni vittadini et al concluded that duration of alcohol intake was one of the important factor in the development of alcoholic neuropathy. They showed that development of neuropathic symptoms need minimum of 5 years of alcohol intake whereas severe polyneuropathy needs at least 10 years of alcohol intake.

Thomas Zambelis et al [41] in their series of 57 alcoholic neuropathy showed that alcoholic neuropathy correlated with duration of alcohol abuse.

Most common sensory symptom in patients with alcoholic neuropathy in our series was pins and needles followed by burning sensation of the both feet. These symptoms are suggesting of small fiber predominant neuropathy. Predominantly they had positive sensory symptoms.

In a study by H. Koike MD et al [42] alcoholic neuropathy patients had, predominantly abnormal sensory symptoms in the form of burning sensation in the lower limbs as their first symptoms.

In our study, 13 patients had autonomic neuropathic symptoms in addition to peripheral neuropathy. Most common autonomic symptoms were erectile dysfunction (13 out of 50 patients) followed by sweating abnormalities (6 patients).

In the autonomic function tests, HRV (Heart Rate Variability) to deep breathing, 15 patients had abnormal HRV ratio to deep breathing. 9 patients out of 50 patients had abnormal fall in the standing blood pressure that is postural hypotension and 14 patients had abnormal SSR (sympathetic skin response); while clinical symptoms of autonomic

neuropathy observed only in 13 patients, autonomic function tests showed autonomic fiber involvement in 15 patients.

In our study, 2 patients had objective autonomic signs before development of subjective symptoms. In our series, only one fourth of alcoholic neuropathy patients had autonomic symptoms and it showed that there is no parallel involvement of somatic and autonomic fibers in alcoholic neuropathy. Subclinical autonomic neuropathy was common in alcoholic neuropathy and these patients should be screened for autonomic dysfunction even in the absence of subjective autonomic symptoms.

Since autonomic dysfunction occurs early on in the disease before symptoms and signs of peripheral neuropathy occur, screening bedside autonomic function tests should be done in all patients with alcoholic neuropathy.

C. Nicolosi et al [43] had similar findings; in their study, one sixth of alcoholic neuropathy had autonomic involvement and there was no statistical correlation between severity of alcoholic somatic neuropathy and autonomic neuropathy.

In a study by M.W. Agelinka [44] et al, 40% of alcoholic neuropathy patients had autonomic neuropathy in the form of abnormal HRV to deep

inspiration and sustained hand grip. In their study, no patients had isolated autonomic neuropathy without peripheral neuropathy.

Roser Monforte et al [45], in their series noted autonomic neuropathy in 24.3% patients and the duration of alcohol exposure correlated to autonomic neuropathy.

Only 12 patients out of 50 had motor weakness in lower limbs in our series.

In our study, majority of patients (56%) had sensory neuropathy and rest of the patients presented with combinations of motor, sensory and autonomic neuropathy.

Out of 50 patients with alcoholic neuropathy, 25 patients had clinically both large and small fiber involvement, 15 patients had small fiber involvement whereas 9 patients had clinically large fiber involvement.

In a study by Thomas Zambelis et al [41], out of 57 chronic alcoholics, 25 patients had features of both large and small fiber neuropathy, whereas 20 patients had large fiber involvement only and rest of the 12 patients had small fiber involvement.

Utah Early Neuropathy Scale Score is used to assess small fiber predominant neuropathies. In our study, Out of 50 patients with alcoholic

neuropathy, 9 patients with age < 30 years had mean Utah Early Neuropathy Scale Score of 21.4, 17 patients had mean Utah Early Neuropathy Scale Score of 26.7 and rest of 24 patients with age of above 40 years had mean Utah Early Neuropathy Scale Score of 33.2. As age increases, Utah Early Neuropathy Scale (UENS) Score increases in our study with statistically significant P value.

Out of 50 patients with alcoholic neuropathy, 10 patients had mean duration of alcohol abuse of less than 5 yrs with mean Utah Early Neuropathy Scale Score of 22.7; 13 patients had mean duration of alcohol exposure of 5 - 10 yrs with mean Utah Early Neuropathy Scale Score of 26.5 whereas 27 patients had mean duration of alcohol exposure of more than 10 yrs with mean Utah Early Neuropathy Scale Score of 32.2. As duration of alcohol abuse increases, Utah Early Neuropathy Scale (UENS) Score increases with statistically significant P value.

Out of 50 alcoholic neuropathic patients, 4 patients had abnormal motor conduction in the upper limbs and 14 in the lower limbs patients in the form of reduced / absent compound motor action potential.

In the sensory conduction, 8 out of 50 patients in the upper limbs and 37 patients in the lower limbs had abnormal conduction in the form of axonopathy. Nerve conduction velocity, latency and F wave studies were normal in all 50 patients. 13 patients with alcoholic neuropathy had

normal conduction with any out electrophysiological evidence of nerve fiber involvement. We found that 13 of our patients with symptomatic neuropathy had normal NCS findings; this discordance is due to the earlier involvement of small fibers in patients with alcohol abuse which is not detected in routine NCS.

Discordance between symptoms of peripheral neuropathy and findings on nerve conduction studies had been reported before by Sangiorgio et al., and Fedele et al.

In a study by A ammendola et al [46], alcoholic neuropathic patient had axonal form in their nerve conduction studies.

In a study by Thomas Zambelis et al [41] all the 42 alcoholic neuropathic patients showed axonal form in electrophysiological exam.

In a study by Matti hillbom et al [47] over 24 alcoholic neuropathic patients, all the patient presented with length dependent neuropathy and electro physiologically axonal changes.

In a study by John P Ballantyne et al [48], alcoholic neuropathic patients had predominantly axonal changes in nerve conduction studies. In their study of 31 alcoholic neuropathy patients, both motor and sensory nerves showed axonal changes. In contrast to our study, in their study, there was no preferential sensory fiber involvement.

In a study by Kimura et al [30], nerve conduction studies in alcohol neuropathic patients had shown axonal changes with preferable involving sensory fibers especially in lower limbs which were similar to our studies.

Conclusion

The following conclusions were made in our study of 50 patients of alcohol neuropathy:

1. Prolonged duration of alcohol intake and increasing age were associated with more severe form of peripheral neuropathy in alcoholic patients.
2. Distal symmetrical polyneuropathy was the commonest mode of presentation of alcohol neuropathy.
3. Most common presenting symptom was pins and needle sensation of both feet.
4. Alcoholic peripheral neuropathy was primarily a painful sensory neuropathy.
5. Discordance between neuropathic symptoms and NCS was found to occur in one fourth of patients.
6. One fourth of alcoholic neuropathic patients had autonomic features.
7. Erectile dysfunction was the most common autonomic symptom in alcoholic neuropathy.
8. Two patients were found to have subclinical autonomic neuropathy.
9. There was no parallel involvement of somatic and autonomic fibers in alcoholic neuropathy.

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ANNEXURES

Proforma:

Name

Age / sex

Duration

Symptoms

- Motor
- Sensory
- Autonomic

Family h/o

Duration of alcohol intake

BMI

Screening for other causes of neuropathy

UENS Score

SMS:

- Weakness
- DTR

Sensory system:

- STT Sensation

- PC sensation

Autonomic signs

- Skin/nail changes
- Postural Hypotension

Other neurological signs

UENS Score

CBC

- Hb
- PS study

RFT

- Creatinine
- Urea

FBS , PPBS

HIV & VDRL

LFT

- Albumin

Autonomic Funtion test

HRV

SSR

Sensory studies

SNAP'S	Latency	AMP (μV)	CV(m/s)
Median Rt			
Median Lt			
Ulnar Rt			
Ulnar Lt			
Sural Rt			
Sural Lt			

Motor studies:

Median Rt	DML	DA	PA	NCV	F latency
Median Lt					
Ulnar Rt					
Ulnar Lt					
Tibial Rt					
Tibial Lt					
Peroneal Rt					
Peroneal Lt					

H reflex:

ABBREVIATIONS:

AFT - Autonomic Function Test

AMP - Amplitude

BF - Burning Sensation of the feet

Blad - Bladder Disturbances

BMI - Body Mass Index

CMAP- Compound Muscle Action Potential

CV - Conduction Velocity

DL - Distal Latency

ED - Erectile Dysfunction

E/I ratio - Expiration / Inspiration ratio

DSM-IV-T - Diagnostic and Statistical Manual of Mental Disorders – IV – Text Revision

DTR - Deep Tendon Reflex

Hb – Hemoglobin

HRV - Heart Rate Variability

Hyper - Hyperesthesia

H/O - History Of

IGT - Impaired Glucose Tolerance test

JPS - Joint Position Test

LFT - Liver Function Test

LL - Lower Limb

m/s – metre/second

NCS - Nerve Conduction Studies

NF – Numbness of the feet

NMDA - N Methyl D asparate

Po. - Positive Symptoms

PN - Postive and Negative Symptoms

Post. Giddiness - Postural Giddiness

PNS - Peripheral Nervous System

P & N – Pins and Needle

PR - Pulse Rate

SN - Sensory Neuropathy

SAN - Sensory Autonomic Neuropathy

SMN - Sensory Motor Neuropathy

SMAN - Sensory Motor Autonomic Neuropathy

SNAP - Sensory Nerve Action Potential

Sr. - Serum

TCA - Tricyclic Antidepressants

UENS Score - Utah Early Neuropathy Scale Score

UL - Upper Limb

Pt No.	Age	Family h/o	Sex	Duration of alcohol exposure	BMI	P & N	BF	NF	Hyper	Allodynia	Unstead	Symptoms	ED	Sweating	Post. Gidd	Blad	Big toe weakness	LL DTR
1	26	No	M	4.5	N	P	P	P	A	A	A	Po	A	A	A	A	N	N
2	27	Yes	M	5	N	P	A	A	A	A	A	Po	A	A	A	A	N	N
3	29	No	M	9.5	Low	P	P	A	P	P	A	PN	A	A	A	A	N	N
4	28	No	M	5	N	A	A	P	A	A	A	Po	P	A	A	A	W	N
5	29	No	M	5	N	P	P	A	A	A	A	Po	A	A	A	A	N	S
6	30	Yes	M	4	N	P	A	A	A	A	A	PN	A	A	A	A	N	N
7	26	No	M	5	N	P	P	A	A	A	A	Po	A	A	A	A	N	N
8	28	No	M	10	N	P	A	P	A	A	A	PN	A	A	A	A	W	A
9	25	Yes	M	5	N	P	P	A	P	P	A	Po	A	A	A	A	N	N
10	35	No	M	9	N	P	A	P	A	A	A	PN	P	A	A	A	N	S
11	38	No	M	15	N	P	P	A	A	A	A	Po	A	A	A	A	N	N
12	34	Yes	M	20	N	P	P	A	A	A	A	PN	A	P	A	A	N	S
13	33	No	M	17	Low	A	A	P	A	A	P	Po	P	A	A	A	W	A
14	39	Yes	M	5	N	P	A	A	A	A	A	Po	A	A	A	A	N	S
15	32	No	M	8	N	P	P	P	P	A	A	Po	A	A	A	A	N	S
16	37	No	M	9	N	P	A	A	A	A	A	PN	A	A	A	A	N	N
17	35	No	M	18	N	P	P	A	P	A	A	Po	A	A	A	A	N	S
18	39	Yes	M	9	Low	A	A	P	A	A	P	PN	P	A	A	A	W	A
19	40	No	M	10	N	P	P	P	A	A	A	Po	A	P	A	A	N	N
20	34	No	M	9	Low	P	A	A	A	A	A	Po	P	A	P	A	N	N
21	32	Yes	M	5	N	P	P	P	P	P	A	PN	A	A	A	A	N	S
22	39	No	M	18	N	P	A	A	A	A	A	Po	A	A	A	A	N	N
23	31	No	M	10	N	A	P	P	A	A	P	Po	P	A	A	A	W	A
24	36	Yes	M	5	N	P	A	A	A	A	A	PN	A	A	A	A	N	N
25	33	No	M	10	N	P	P	P	A	A	A	Po	A	A	A	P	N	S

M - Male | P - Present | Ab. - Abnormal | S- Sluggish | SN - Sensory neuropathy | S - Small fiber

A -Absent | PN - Positive & Negative | L - Large fiber

Po - positive | Ne - Negative | SAN - Sensory Autonomic neuropathy | SMN - Sensory Motor Neuropathy

LS - Large small fiber | SMAN - Sensory Motor Autonomic Neuropathy

UL DTR	Diagnosis	Fiber type	UENSS	UL CMAP	UL SNAP	LL CMAP	Sural SNAP	H reflex	HRV	Postural hypotension	SSR	Hb	Albumin
N	SN	LS	22	N	N	N	A	N	N	N	N	N	N
N	SN	S	16	N	N	N	N	N	N	N	N	N	N
N	SN	LS	24	N	N	N	A	N	N	N	N	Low	Low
N	SMN	L	26	N	N	A	A	A	N	N	N	N	N
N	SN	LS	20	N	N	N	A	N	N	N	N	N	N
N	SN	S	30	N	N	N	N	N	N	N	N	N	N
N	SN	LS	20	N	N	N	A	N	N	N	N	N	Low
N	SMN	L	18	N	N	A	A	A	N	N	N	N	N
N	SN	LS	17	N	N	N	A	N	N	N	N	N	N
N	SAN	LS	22	N	N	N	A	A	Ab.	N	A	N	N
N	SN	S	28	N	N	N	N	N	N	N	N	N	N
N	SN	LS	32	N	N	N	A	N	N	N	N	N	N
N	SMN	L	26	N	N	A	A	A	N	N	N	Low	Low
N	SN	LS	22	N	N	N	A	N	N	N	N	N	N
N	SAN	LS	26	N	N	N	A	N	Ab.	P	A	N	N
N	SN	S	28	N	N	N	N	N	N	N	N	N	N
N	SAN	LS	32	N	N	N	A	N	Ab.	N	A	N	Low
N	SMN	L	26	N	N	A	A	A	N	N	N	Low	N
N	SAN	LS	32	N	N	N	A	N	Ab.	P	A	N	N
N	SN	S	24	N	N	N	N	N	N	N	N	N	N
S	SAN	LS	22	N	N	N	A	A	Ab.	N	A	Low	N
N	SN	S	24	N	N	N	N	N	N	N	N	N	Low
A	SMN	LS	30	N	N	A	A	A	N	N	N	N	N
N	SN	S	22	N	N	N	N	N	N	N	N	N	N
N	SAN	LS	24	N	N	A	A	A	Ab.	P	A	Low	Low

Pt No.	Age	Family h/o	Sex	Duration of alcohol exposure	BMI	P & N	BF	NF	Hyper	Allodynia	Unstead.	Symptoms	ED	Sweating	Post. Gidd	Blad	Big toe weakness	LL DTR
26	37	Yes	M	20	N	P	A	A	A	A	A	PN	A	P	A	A	N	N
27	42	No	M	15	N	P	P	P	A	A	A	Po	P	A	A	A	W	S
28	46	No	M	16	N	P	A	A	A	A	A	PN	A	A	A	A	N	N
29	49	Yes	M	18	Low	P	P	A	P	P	A	Po	P	A	P	A	N	N
30	41	No	M	8	N	P	A	A	A	A	A	Po	A	A	A	A	N	N
31	43	Yes	M	20	N	A	A	P	A	A	A	Ne	A	P	A	A	W	A
32	48	No	M	17	N	P	P	A	P	P	A	PN	A	A	A	A	N	S
33	47	Yes	M	15	Low	A	A	P	A	A	A	Ne	P	A	A	A	W	S
34	48	No	M	17	N	P	P	A	P	A	A	Po	A	P	A	A	N	N
35	43	Yes	M	15	N	A	A	P	A	A	P	PN	A	A	A	A	W	A
36	47	No	M	20	N	P	P	A	P	P	A	PN	A	A	A	A	N	N
37	43	No	M	18	N	P	A	P	A	A	A	Po	P	A	A	A	N	S
38	42	Yes	M	8	N	P	P	A	P	A	A	PN	A	A	A	A	N	N
39	43	No	M	19	N	P	P	A	A	A	A	Po	A	A	A	A	N	S
40	45	Yes	M	20	N	A	A	P	A	A	P	Ne	P	A	P	A	W	A
41	44	Yes	M	18	N	P	P	A	P	A	A	Po	A	P	A	A	N	N
42	47	No	M	8	N	P	A	P	A	A	A	PN	A	A	A	A	W	A
43	41	No	M	12	N	P	P	A	A	A	A	Po	A	A	A	A	N	N
44	45	No	M	15	N	P	P	A	P	P	A	PN	P	A	A	A	N	S
45	42	Yes	M	18	N	P	A	A	A	A	A	PN	A	A	A	A	N	S
46	49	No	M	15	Low	P	P	A	A	A	A	Po	A	P	A	A	N	N
47	44	No	M	20	N	P	P	A	P	P	A	Po	A	A	P	A	N	S
48	43	No	M	17	N	P	P	A	A	A	A	PN	P	A	A	A	N	N
49	48	No	M	25	N	A	A	P	A	A	A	Ne	A	A	A	A	W	A
50	45	Yes	M	18	N	P	P	A	P	A	A	PN	A	A	A	A	N	S

UL DTR	Diagnosis	Fiber type	UENSS	UL CMAP	UL SNAP	LL CMAP	Sural SNAP	H reflex	HRV	Postural Hypotension	SSR	Hb	Albumin
N	SN	LS	34	N	N	N	A	N	N	N	N	N	N
S	SMN	L	34	N	A	A	A	A	N	N	N	N	N
N	SN	S	36	N	N	N	N	N	N	N	N	N	N
N	SAN	LS	34	N	N	N	A	A	Ab.	N	A	Low	Low
N	SN	LS	30	N	N	N	A	N	N	N	N	N	N
N	SMN	L	38	N	N	A	A	A	N	N	N	N	N
N	SN	LS	34	N	N	N	A	N	N	N	N	N	N
S	SMAN	L	28	N	A	N	A	A	Ab.	P	A	Low	Low
N	SN	S	30	N	N	N	N	N	N	N	N	N	N
N	SMN	LS	24	A	A	A	A	A	N	N	N	N	N
N	SN	S	36	N	N	N	N	N	N	N	N	N	N
S	SAN	LS	40	N	N	A	A	A	Ab.	P	A	Low	Low
N	SN	S	28	N	N	N	N	N	N	N	N	N	N
N	SN	LS	32	N	N	N	A	A	N	N	N	N	Low
A	SMN	L	36	A	A	A	A	A	N	N	N	N	N
N	SN	S	34	N	N	N	A	N	N	N	N	N	N
N	SMAN	LS	32	A	A	A	A	A	Ab.	P	A	Low	Low
N	SN	S	30	N	N	N	N	N	N	N	N	N	N
N	SAN	LS	32	N	N	N	A	N	Ab.	P	A	N	N
S	SN	LS	34	N	A	A	A	A	N	N	N	N	N
N	SN	S	32	N	N	N	N	N	Ab.	P	N	Low	Low
N	SAN	LS	36	N	N	N	A	A	Ab.	P	A	N	N
N	SN	S	32	N	N	N	A	N	N	N	N	N	N
A	SMAN	L	44	A	A	A	A	A	Ab.	N	A	N	Low
N	SN	LS	32	N	N	N	A	A	Ab.	N	N	Low	N